NEW ENGLAND ECOSYSTEMS 1997

Nature is in it for the long haul.
–Jim Harrison

Amelia Katzen

New England is home to a variety of diverse ecosystems. From the dense Northern Forest to wind-blown salt marshes and salt ponds, our region's ecosystems provide a range of habitats for wildlife as large as the black bear to the smallest crabs living among blades of eelgrass. Human activities can significantly alter our environment by affecting interrelated ecosystems throughout our region. Environmental indicators help us characterize the level of stress in an ecosystem, describe an ecosystem's response to human activities and disturbances, and predict where harm to living organisms is likely to occur.

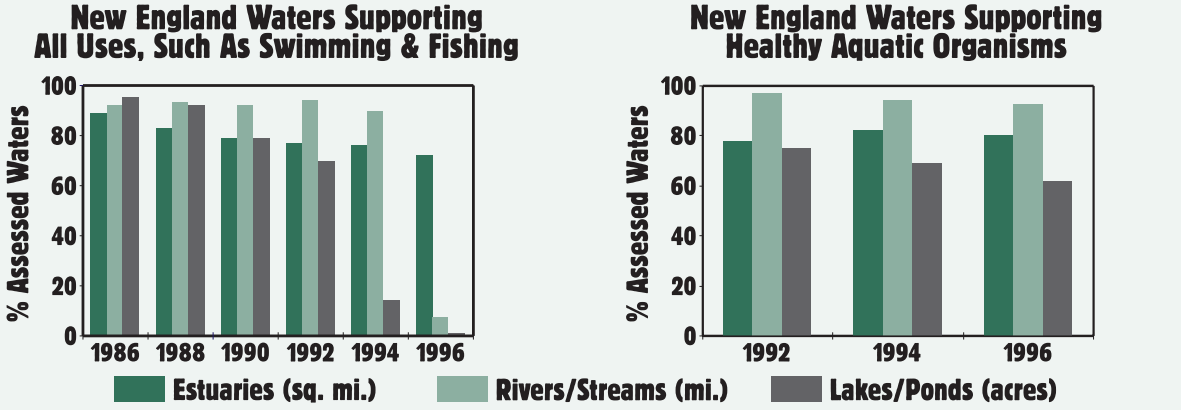
WATERWORLDS: AQUATIC LIFE & BIOLOGICAL ASSESSMENT

Every year, state, local, and federal agencies, along with numerous volunteer monitoring groups, collect information about water quality in streams, rivers, lakes, ponds, and estuaries. Information about water quality, toxicity, and the composition of biological communities forms the basis of most assessments. The presence and numbers of fish species and small aquatic organisms (macroinvertebrates), for example, are good indicators of water and sediment quality, since some are more sensitive to pollution than others.

More than 80% of New England's rivers, and more than 60% of our lakes and estuaries, fully support aquatic life (Figure 1). The most significant problems that have been identified for aquatic life are eutrophication from agricultural and sewage sources, siltation and runoff from silviculture (forestry practices), nuisance aquatic species such as zebra mussels or weeds, stormwater runoff, and low water flow.

Ecosystems Figure 1

Fewer Lakes & Rivers Support All Uses



Source: State 305(b) Water Quality Inventory Reports and Fish Consumption Advisories

Ecosystems Figure 2

Sediments in New England

Locations with potential adverse environmental effects, based on current sediment data

Source: National Sediment Inventory

PROBLEMS IN THE MUD: CONTAMINATED SEDIMENTS

Toxic chemicals in water from industrial facilities, sewage treatment plants, and urban and agricultural runoff tend to settle and accumulate in the bottom sediments of rivers and bays. These contaminants, which include PCBs, pesticides, and metals, can affect the benthic (bottom-dwelling) community or move up the food chain to other fish, birds, and in some cases, humans.

Results obtained from EPA's National Sediment Inventory (NSI) show that, where samples have been collected and reported, sediment contamination is widespread in many New England watersheds (Figure 2). EPA studies have shown that approximately 40% (by area) of southern New England's small coastal estuaries have benthic communities that have been impacted by elevated levels of sediment contamination.

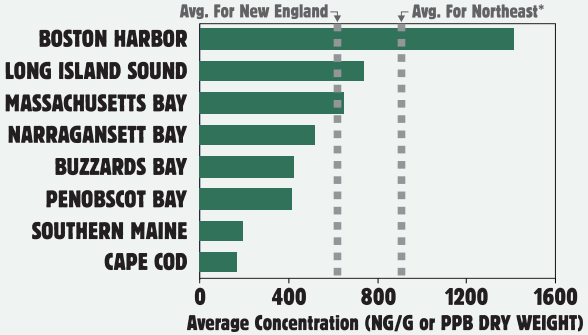
MEANINGFUL MUSSELS: AN INDICATOR SPECIES

Measurements of mussel tissues are often utilized to determine contaminant concentrations in coastal waters because they mirror overall water and sediment quality in an area. The National Oceanic and Atmospheric Administration (NOAA) has been measuring close to 100 different contaminants in mussels at twenty-nine New England sites almost every year since 1986. High concentrations of certain contaminants, such as PCBs and polychlorinated aromatic hydrocarbons (PAHs) near New Bedford Harbor and in urban environments such as Boston Harbor or coastal Connecticut, have been detected in areas where known contaminant releases have occurred (Figure 3).

Between 1986 and 1993, both in New England as a whole and nationally, concentrations of many contaminants in mussels have decreased, some have remained constant, but none have increased. Those chemicals that have declined include: PCBs and the pesticide chlordane, which have either been banned or are no longer used; butylins, formerly used as ingredients in antifouling boat paints but since restricted because of their toxicity; and copper, which has not been restricted.

Ecosystems Figure 3

Polycyclic Aromatic Hydrocarbons (PAHS) in Mussels



*Northeast is Delaware to Maine

Source: NOAA, Status & Trends, 1995

SPECIAL PLACES

EPA has embarked on a series of Resource Protection Projects to identify high priority natural resources and to develop and implement strategies to protect them – six priority areas in New Hampshire, nine in Rhode Island, and nine in Connecticut. EPA has targeted twenty-five watersheds and other special places as part of our Community-Based Environmental Protection focus. We are working with community groups, and state and local governments, to set tangible environmental goals and to develop action plans that combine targeted enforcement actions, technical assistance, grant funding, and public education. For example, the Lower Charles River Initiative has set a goal to be fishable and swimmable by Earth Day 2005.

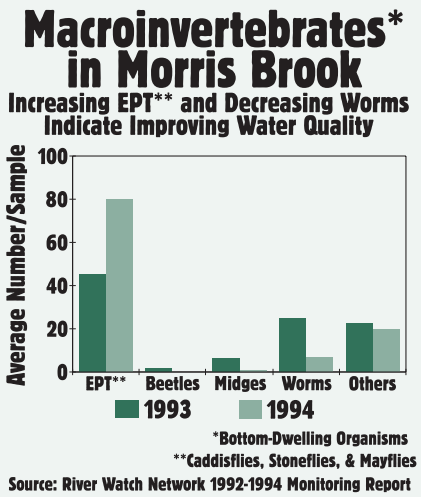
GIANT STEPS IN CLEANING A HARBOR

New Bedford Harbor on Buzzard's Bay in Massachusetts has the potential to provide significant economic and recreational benefits to the region, but decades of inappropriate industrial waste discharges have made it one of the largest PCB-contaminated Superfund sites in the nation. As a result, the Massachusetts Department of Public Health has restricted lobstering and fishing over a 18,000-acre area. As part of a Phase One "hot spot" remedy for the site, 14,000 cubic yards of the most contaminated sediments were dredged and placed in temporary storage.

In 1996, after working with surrounding harbor communities, EPA's New England Office established a broad-based consensus on a Phase Two cleanup approach to dredge and isolate another 500,000 cubic yards of contaminated sediment and explore alternatives for its treatment. Our work in New Bedford has begun the process of restoring the harbor on a scale that can revitalize both its true ecological and economic opportunities.

MORRIS BROOK DAIRY FARM: PROTECTING AQUATIC LIFE

Dale Lewis owns a dairy farm located on Morris Brook, a tributary that feeds into the Connecticut River in New Hampshire. In 1991, he volunteered to join with EPA and the New Hampshire Department of Environmental Services in a project to control erosion and runoff of cow manure and fertilizer entering the brook. Manure storage areas, concrete pads in heavy animal use areas, house and barn roof drains, and a brook crossing were constructed. Volunteers and staff from the Connecticut River Watch Program collected and analyzed water and macroinvertebrate samples to determine whether the biological community would respond to reduction in sediment and manure runoff.



After implementation of runoff controls, the macroinvertebrate community downstream from the Lewis Farm significantly improved; the relative abundance of pollution-tolerant organisms declined, while pollution-intolerant species increased. This improvement can be directly linked to reductions in sediments and manure running off into the stream. As a result of his efforts, Dale Lewis was a recipient of EPA's Environmental Merit Award.

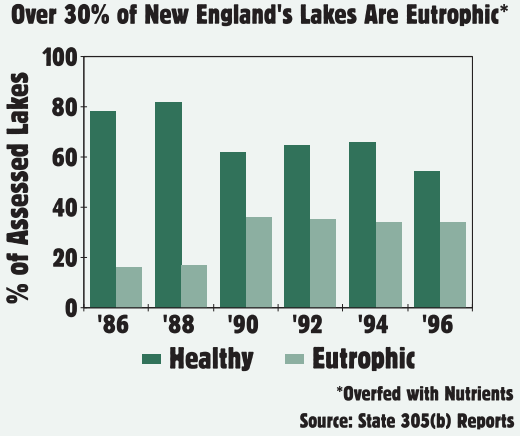
WASHING IN AND RAINING DOWN: EUTROPHICATION & ATMOSPHERIC DEPOSITION

Discharges from sewage treatment plants and non-point sources, such as agricultural runoff and atmospheric deposition, result in increased amounts of phosphorus and nitrogen in New England's lakes, rivers, and coastal bays. This inadvertent over-fertilization causes increased growth of aquatic plants and algae. When these plants die and decompose, the supply of dissolved oxygen in the water is depleted, leaving less oxygen available for other aquatic organisms. This process, called eutrophication, results in low dissolved oxygen, extensive algal blooms, high levels of turbidity (suspended material), fish kills, and loss of sensitive benthic (bottom-dwelling) animals in the ecosystem. Indicators show that about 32% of New England's lakes are eutrophic (Figure 4). Symptoms of eutrophication in estuaries, which include declining eelgrass populations and growth of nuisance algae, have worsened in Buzzards Bay, Narragansett Bay, Long Island Sound, and Waquoit Bay since the 1970s. Records from sewage treatment plants in the region show that the total loads of nitrogen and phosphorus from wastewater treatment plants have either remained the same or increased slightly from 1991 to 1995 (Figure 5).

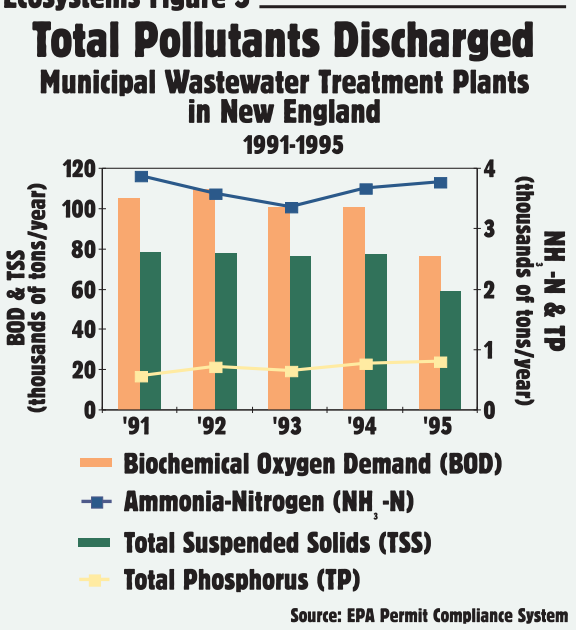
Progress has been made in reducing nitrogen released by sewage treatment plants into some estuaries, particularly in Long Island Sound. Partnerships with local, state, and federal agencies are also needed to stem the increase in eutrophication of New England's lakes and coastal bays.

Atmospheric deposition also contributes to eutrophication, particularly since New England has the highest atmospheric nitrogen loadings in the nation. This is the result of New England's location "downwind" from major sources in the industrial Midwest, automobile traffic in the Washington-to-Boston urban

Ecosystems Figure 4



Ecosystems Figure 5



corridor, and heavier rain and snowfall than other parts of the country. Although sulfate levels have declined since the passage of the 1990 Clean Air Act Amendments, which control sulfur emissions from power plants, nitrate deposition has not declined significantly (Figure 6). EPA is working with the New England states to reduce nitrogen oxides by capping power plant emissions and promoting mass transportation and alternative fuel technologies.

In addition to its role in eutrophication, the air over New England influences both terrestrial and aquatic ecosystems in other ways. Air pollution can damage or inhibit plant and animal growth, and disrupt the chemical balance of life-supporting soil and water. Lead, particles, sulfur dioxide, ozone, and other air pollutants have been measured in New England since the late 1960s as part of an EPA-sponsored ambient air monitoring network. Over the past decade, air quality indicators show that both emissions, and concentrations of particulate matter and sulfur dioxide have decreased. Concentrations of ozone and ozone precursor emissions, however, do not show significant reductions. More reductions are needed to help us stop long-term damage to our ecosystems, climate, and human health.

ECO-RISK

EPA inventories help identify the sources and extent of contamination of our ecosystems. Another tool for assessing the effect of contamination on ecosystems, which helps evaluate the probability of harm from contaminants, is ecological risk assessment (called "eco-risk"). To date, EPA and the New England states have used "eco-risk" extensively in waste site remediation, and this approach will have a greater role in the overall cleanup, restoration, and management of many ecosystems in the future. For example, eco-risk is being used in EPA's Waquoit Bay Case Study to develop a model for watershed protection that identifies stressors in the aquatic habitats of the watershed and assesses their impacts on aquatic species.

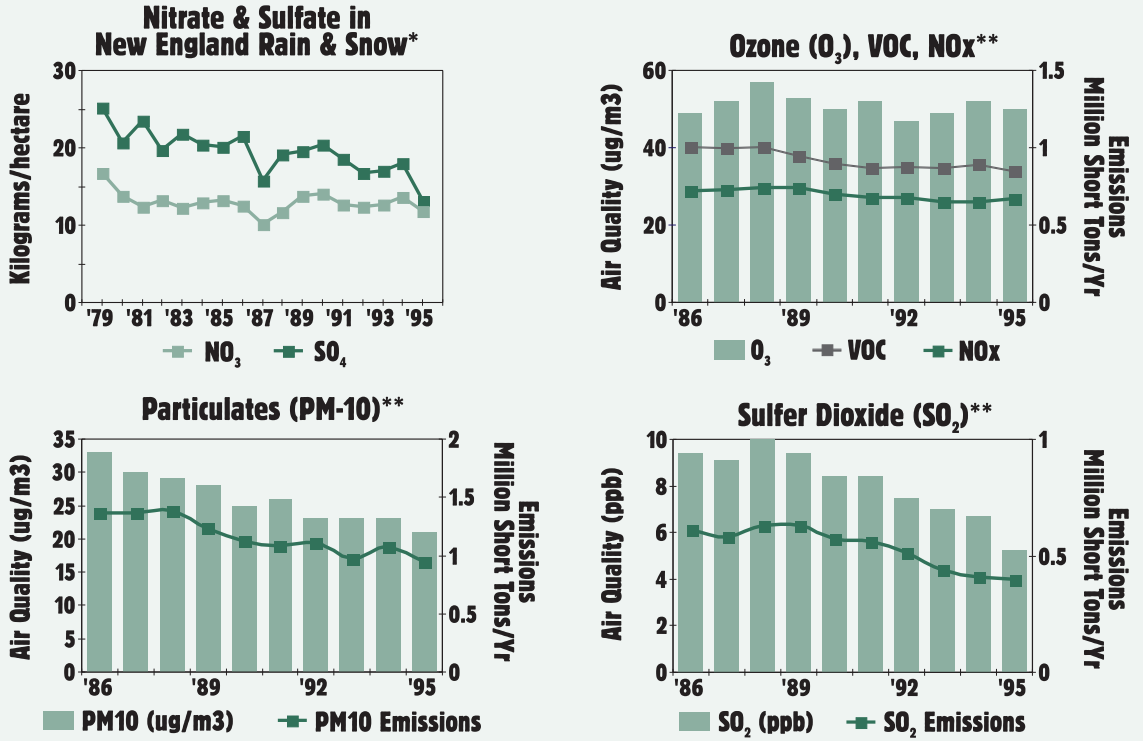
THE CUMBERLAND FARMS SETTLEMENT: PRESERVING HABITAT

Protecting wetlands requires creative vigilance from local, state, and federal agencies. One approach includes land conservation in tandem with enforcement. In 1996, a federal district court in Boston approved a civil consent decree between the United States and Cumberland Farms, Inc., resolving a long-standing action against Cumberland Farms for unpermitted filling of 180 acres of wetlands in Halifax and Hanson, Massachusetts. Under the consent decree, Cumberland is required to deed 225 undeveloped acres to the Massachusetts Division of Fisheries and Wildlife for permanent conservation. In addition, the company will establish a 30-acre wildlife and wetlands corridor on the most seriously damaged wetlands and will pay a $50,000 civil penalty.

This settlement will preserve a total of 490 acres of undeveloped habitat and represents the largest permanent preservation of habitat arising from a federal enforcement action in New England.

Ecosystems Figure 6

Air Quality in New England



*Source: National Atmospheric Deposition Program (NADP 1996) ** Air Quality data are yearly/seasonal means for selected air quality sites; Source: AIRS/NARIP

A QUIET INVASION: BIOLOGICAL NUISANCES & ALIEN SPECIES

Even though they were not originally part of our ecosystems, most of the 4,000 non-native plant species and 2,300 non-native animal species in the United States pose little threat. Those that cause damage, however, do so on a grand scale. Just seventy-nine of these species have cost the economy $97 billion to date. They alter the character of our ecosystems, place additional pressure on species that are already at risk, and adversely impact native species. Expanding global travel and trade provide still more opportunities for biological nuisances and alien invaders to reach our shores.

Eurasian watermilfoil, a submerged aquatic plant, has infested all New England states except Maine, restricting recreation, harming fisheries, and out-competing and eliminating native plants. Accidentally introduced into the United States in the 1940s, Eurasian watermilfoil has no known natural controls and can adapt to a variety of environmental conditions.

LEAD AND MERCURY CONTAMINATION IN NEW ENGLAND LOONS

Lead and mercury are two of the most prevalent toxic heavy metal compounds threatening loons. Since 1989, more than 400 dead or dying loons have been collected from freshwater and coastal areas of all six New England states. These birds died as a result of trauma, ingesting metal fishing gear, and disease. Lead fishing gear was found in over half the loons from freshwater lakes. In heavily used areas, such as Lake Winnepasaukee, more than 80% of loon deaths were related to lead poisoning from ingesting lead sinkers. Loons are very sensitive to lead poisoning and die rapidly after ingesting even small amounts of lead. Legislation in the United States has been proposed, but not enacted, to limit lead fishing gear. Alternatives to lead shot and sinkers are beginning to be marketed. Samples taken from New England loons show that mercury levels are also significantly elevated and higher than those found in loons in other regions of the United States. Fish-eating birds, such as loons and bald eagles, evidently bioaccumulate mercury because of the elevated levels in many New England lakes and rivers.

Purple loosestrife, a native of Eurasia, was first seen in North America in 1814 and has since spread to wetlands throughout the United States. It is particularly abundant in disturbed wetlands in all six New England states, crowding out native plants and threatening rare amphibians and butterflies dependent on native vegetation. Known for its bright pink flowers, purple loosestrife is still sold commercially for landscaping in some areas.

The common reed (*Phragmites*) is a tall perennial grass found in all New England states. In disturbed wetland areas associated with stormwater runoff, *Phragmites* often forms dense, single-species stands, disrupting wetland habitats and their associated wildlife. Both coastal and inland wetlands are threatened by its proliferation.

Zebra mussels are small mollusks native to Eastern Europe, first introduced to the United States in the Great Lakes in 1986. Currently, they are spreading throughout Lake Champlain and may soon reach the Connecticut River. Zebra mussels pose a threat to all New England waters and may eliminate many native freshwater mussels already under stress from pollution.

Most non-native species can never be eliminated, although their spread can be controlled. Eurasian watermilfoil and zebra mussels can be controlled by removing and properly disposing of all plant fragments and removing mussels from boats. The best control mechanism in the case of purple loosestrife and *Phragmites* is to keep wetlands intact and minimize other kinds of wetland disturbances as much as possible.

PROTECTING & RESTORING LAKE CHAMPLAIN

On November 16, 1990, Congress enacted the Lake Champlain Special Designation Act, identifying the lake as a resource of national significance and establishing a goal to bring a variety of stakeholders together to create a comprehensive plan for protecting the lake and its surrounding watershed. Home to more than 600,000 people – 180,000 of which use it for drinking water – the Lake Champlain Basin stands as a unique environmental, cultural, recreational, and economic resource that should be preserved for future generations. In 1990, the Lake Champlain Basin Program (LCBP) was established to coordinate the ecosystem and watershed-based activities envisioned in the Act. As a lead agency of the LCBP, EPA has provided more than $8 million and countless hours of technical and policy assistance in an effort to develop a pollution prevention, control, and restoration plan for the basin.

The payoff for all of this hard work came on October 28, 1996, when EPA and the states of Vermont and New York signed "Opportunities for Action: An Evolving Plan for the Future of the Lake Champlain Basin." Highlighting the need for phosphorus, toxic substance, and nuisance aquatic plant reduction strategies, the plan is now moving into the implementation phase – another step toward the long-term preservation of a precious New England resource. The Plan sets goals for phosphorus reduction throughout the lake, aiming for a 25% reduction every five years for the next twenty years.

WETLANDS

Because of their importance as habitat, their role in sustaining and restoring water quality, and their recreational values, wetlands in New England are protected by federal, state, and local laws.

New England's wetlands have been seriously impacted by human activities. Estimates of original wetland coverage and losses since the 1700s vary widely. Currently, we have approximately 11 million acres of freshwater wetlands – ranging from marshes to forested areas – and 270,000 acres of estuarine wetlands. Vermont estimates that 118 acres of freshwater wetlands have been lost and 265 acres impaired since 1990. New Hampshire estimates that up to 250 acres have been altered or lost over the last couple of years. Connecticut and Maine, however, estimate that 250 acres per year are altered or lost. Primary reasons for current wetland loss in New England are filling, draining, and dredging associated with agriculture, and urban and suburban sprawl.

EPA's New England Office is vigorously curtailing wetland loss and degradation by supporting state and local efforts to protect and restore this vital resource. In partnership with the Corps of Engineers and the states, regulations are being streamlined, becoming clearer and fairer to applicants, and getting more protective of important public resources. EPA's enforcement arsenal is also used to restore wetlands and penalize those who flagrantly violate wetland protection laws.

SEARS ISLAND: HOPE FOR THE FUTURE

For more than fifteen years, the Maine Department of Transportation (ME DOT) planned to construct a major cargo port at Sears Island, a 940-acre undeveloped island off of the coast of Maine. The project would have eliminated 12 acres of productive eelgrass beds (vitally important for several species, including lobsters, crabs, and menhaden), roughly 15 to 30 acres of valuable freshwater wetlands, and 12 acres of valuable intertidal habitat supporting high densities of softshell clams.

During 1996, two significant events occurred:

First, ME DOT suspended plans for the cargo port at Sears Island, removing the most immediate threat to its freshwater and marine environment for the foreseeable future. Proposed modernization of nearby Mack Point's existing port – an industrial Brownfields site – is in the conceptual planning stage and would involve substantially less environmental harm than one constructed at Sears Island.

Second, EPA and ME DOT settled the enforcement case arising from illegal filling of 10 acres of freshwater wetlands at the island. Under a consent decree, ME DOT will put $800,000 toward wetland restoration and land preservation projects on Sears Island and on the mainland near Penobscot Bay. ME DOT will:

- remove the fill from and restore 3.2 acres of freshwater wetlands on the island, at site of ME DOT's proposed port;
- create at least one vernal pool at the restored area;
- restore 0.75 acres of wetlands at the south/central end of the island, which were degraded when unknown persons removed the topsoil;
- acquire and restore 17 acres of degraded pasture land – resulting in the land reverting to wetland - along the Dyer River, a tributary to the Sheepscot River that is habitat for the Atlantic Salmon – a species the U. S. Fish and Wildlife Service proposes to be listed as threatened; and
- invest at least $100,000 toward the purchase of valuable wetlands along the Ducktrap River, which also acts as critical habitat for Atlantic salmon.

Furthermore, under the decree, three contractor defendants who did design and construction work on the port project will pay a $10,000 cash penalty.